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PT-PHOS-001
REV: C
DATE: Q3-04-02

PHOSPHATE COATING PROCEDURE

SCOPE: To establish a procedure which covers the application of zinc phosphate coating on ferrous alloys, meeting the requirements of MIL-DTL-16232.

1.0 SOLUTION CONTROL

- 1.1 A record will be kept of the history of each processing bath showing all additions of chemicals and results of the analysis performed for no less than one year.**
- 1.2 Records of bath controls shall be maintained and made available to the DCMAO representative or command upon request.**

2.0 MATERIALS:

2.1 Pre-Cleaning:

- 2.1.1 Alkaline Cleaner Material: Oakite 90; 5 – 15 minutes; temperature: 140°F to 190°F; and concentration: 6.0 to 10.5 oz/gal.**
- 2.1.2 Abrasive Blast Media: Type: Sand/Glass Bead from SanMar: MIL-SPEC-8 - sieve range size 70 - 120
Also available: S0230 steel shot (to be used only when directed customer contract)**
- 2.1.3 Zinc Phosphate Solution: Mi-Phos ZM by Hubbard Hall
Time: 3 to 15 minutes; Temperature: 170°F - 185°F;
Concentration: 6.0 – 10.0 gal/100 gal.**
- 2.1.4 Final Rinse: Chromic Acid: Chromic Acid Flakes by Dycho Chemicals – concentration: 0.04 oz/gal.**

ATTACH 004

SUPPLEMENTAL TREATMENTS:

2.1.5 Oil Preservative: Brayco 883 by Castrol

2.1.5 Dry Film Lubricant:
MIL-L-46010 Type III EM Corporation
(Everlube 9002)
MIL-L-23398 EM Corporation

3.0 PROCESS

- 3.1 Inspect incoming parts for hardness (Rockwell C) and alloy type in addition to inspection for defects and damage. Dimensions and surface finish apply before phosphating unless otherwise specified. Phosphating will be applied after all machining, welding, forming, heat treatment, etc. have been completed. If production parts are not capable of being tested due to physical size restraints, sections of parts will be utilized.**
- 3.2 A stress relief heat treatment is required for parts Rockwell C 39 and above. Parts including carburized parts, which are Rockwell C39 or harder, or parts of any hardness which are ground, cold formed or cold straightened, shall be given a stress relief heat treatment of 350°F to 400°F for a minimum of ONE hour for EACH inch of thickness, but not less than ½ hour for a thickness of less than ½ inch. Optional heat treatment for carburized parts is 225°F to 275°F for 8 hours.**
- 3.3 Alkaline Clean using Oakite 90 for 5 – 15 minutes as needed at 140°F to 190°F.**
- 3.4 Rinse**
- 3.5 Dry**
- 3.6 Mask or plug holes as needed**
- 3.7 Abrasive blast using Glass bead per MIL-SPEC-8 and any residue will be cleaned from parts with a blast of clean, dry air. Inspect to ensure parts are thoroughly cleaned.**
- 3.8 Zinc Phosphate coat in Mi-Phos ZM for 3 – 15 minutes at 170°F to 185°F at a concentration 6.0 – 10.0 gal/100 gal. The ratio of Total Acid to Free Acid range to be 6.0 : 1 – 8.0 : 1. Total acid range will be kept at 23.4 – 33.6. Free acid range will be kept at 3.9 – 4.2. Iron control will be controlled in accordance with total acids with the ideal range to be 2.5 to 4.5 (iron).**
 - 3.8.1 Solution is to be tested immediately prior to starting of production and every four (4) hours during production. (During periods of nonuse, the solution bath will be tested weekly to maintain bath.)**
- 3.9 Solutions should not be allowed to dry on parts prior to rinsing.**

- 3.10 Rinse in clear cold running water for a minimum of at least one (1) minute. Water flow shall be regulated to prevent contamination and it shall be maintained at less than 100 ppm total dissolved solids.
- 3.11 A chromic acid rinse will be applied at 150°F to 200°F on all parts except when Class IV coatings are specified. This rinse will be maintained at a pH of 2.0 – 4.0 by the addition of chromic acid flakes. The rinse will be analyzed prior to the start of production and at least every 8 hours thereafter by a standard free acid and total acid titration along with a pH reading. The rinse will be discarded when the free acid to total acid ratio exceeds a value of 7.0. The parts will remain in the rinse for a minimum of one (1) minute and then removed. A blast of dry air may be used to aid in the drying process.
- 3.12 Parts Rockwell C 39 or harder will be given the specified supplementary treatment and allowed to age at room temperature for 120 hours to relieve any hydrogen embrittlement. If necessary, parts will be baked at 220 +/- 5°F for eight (8) hours to relieve hydrogen embrittlement and then will be given the specified supplementary treatment.
- 3.13 If production tests are used for testing or examination, they shall be removed at this time.

4.0 EQUIPMENT

- 4.1 Equipment is constructed of materials resistant to the action of the phosphating solution and shall be free to copper alloy fittings and brazing materials. Solution will not be allowed to dry on the parts prior to rinsing.

5.0 TESTING REQUIREMENTS:

- 5.1 Workmanship shall comply with paragraph 3.10 of MIL-DTL-16232 and shall be evenly deposited, and shall have a uniform crystalline texture with a pattern not readily visible to the unaided eye and shall not produce any evidence of etching or intergranular attack of the base metal. Coatings shall be gray to black, and will not have a mottled appearance. They shall be free of white stains, rust, and fingerprints. Brown or orange stains caused by the chromic acid rinse and non-uniformity of color due to heat treatment shall not be cause for rejection.
- 5.2 Salt spray tests shall be performed in accordance with ASTM B117 on Coatings prior to the application of supplementary treatments. Parts shall show no signs of corrosion visible to the unaided eye after exposure times of 2.0 hours.
- 5.3 Coating weight tests will be performed in accordance with the requirements of MIL-DTL-16232. A minimum of 11 gr/mtr squared is required. Results of these tests shall be recorded and kept on file.

- 5.3.1 Weigh the coated test specimen to the nearest mg. Remove the Coating by immersion for a minimum of 15 minutes in a stripping solution made up of 50 gr/ltr chromic acid at approximately 165°F. Rinse in clean, running water. Dry and reweigh. Repeat the procedure until a constant weight is obtained. Calculate the weight of the phosphate coating as follows:**

$$W \text{ (g/m}^2\text{)} = \frac{\text{(Initial weight in grams – final weight in grams)}}{\text{Total area in square meters}}$$

- 5.4 Adequacy of the hydrogen embrittlement relief treatment will be tested at 120 day intervals by testing in accordance MIL-DTL-16232 using test specimens of 4340 steel with a Rockwell C hardness value of 51-53 or above. Three uncoated, notched tensile specimens will be pulled to determine the ultimate notched tensile strength. Specimens subjected to the phosphate coating procedure and given the embrittlement relief treatment will be subjected to a load of 75% of the ultimate notched tensile strength for 200 hours. Specimens will be examined for cracks after the test.**
- 5.5 Testing for salt spray and coating weight will be accomplished at least per lot, once every eight (8) hours or less.**
- 5.6 Parts requiring a specific thickness of paint will be measured using an approved thickness tester (Fischer Dualscope) after the paint has sufficiently dried. Film thickness of the paint shall include any thickness that may result from the phosphate coating.**